Product User Guide

RFVolt2000A

RFVolt2000A
Wireless Voltage Data Logger

MADGETECH
WE BUILD DATA LOGGERS

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Quick Start Steps

Product Operation (Wireless)

1. Install the MadgeTech 4 Software and USB Drivers onto a Windows PC.
2. The RFC1000 interface device comes with a USB cable. Plug one end of the cable into an available USB port on the PC and plug the opposite end of the cable into the communication port on the RFC1000.
3. Push and hold the wireless button on the RFVolt2000A for 5 seconds to activate wireless communication. The display will confirm “Wireless: ON” and the blue LED will blink every 15 seconds.
4. Launch the MadgeTech 4 Software. All active MadgeTech Data Loggers that are within range will automatically appear in the connected devices window. Each data logger in the list can be identified by serial number (printed on the exterior of the logger).
5. To claim a device, select the desired data logger in the list and click the **Claim** icon.
6. Select the start method, reading rate and any other parameters appropriate for the desired data logging application. Once configured, deploy the data logger by clicking the **Start** icon.
7. To download data, select the device in the list, click the **Stop** icon, and then click the **Download** icon. A graph will automatically display the data.

Product Operation (Plugged In)

1. Install the MadgeTech 4 Software and USB Drivers onto a Windows PC.
2. Before plugging the data logger in the computer, make sure the wireless setting on the device is set to “Wireless: OFF”. If wireless mode is on, press and hold the Wireless button on the device for 5 seconds.
3. The RFVolt2000A comes with a USB cable. Plug one end of the cable into an available USB port on the PC and plug the opposite end of the cable into the communication port on the RFVolt2000A.
4. Launch the MadgeTech 4 Software. The RFVolt2000A will appear in the connected devices window indicating the device has been recognized.
5. Select the start method, reading rate and any other parameters appropriate for the desired data logging application. Once configured, deploy the data logger by clicking the **Start** icon.
6. To download data, select the device in the list, click the **Stop** icon, and then click the **Download** icon. A graph will automatically display the data.

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Product Overview

The RFVolt2000A is a wireless data logger designed to measure and record DC voltage signals. The data logger can connect directly to DC voltage sources which makes it ideal for battery usage studies, solar energy monitoring and other DC voltage monitoring applications. The RFVolt2000A can also be interfaced with a wide range of voltage output sensors, including pressure sensors and CO2 sensors, as well as transmitters and other transducers. The RFVolt2000A is available in a 2.5V, 15V, 30V or 160mV measurement range.

The RFVolt2000A features an LCD screen which provides instant access to the current reading, minimum, maximum and average statistics. Through the software, the device can be programmed with engineering units, which convert the voltage signals into a different unit of measure such as PSI, % or PPM. The engineering unit is available for display on the LCD screen as well as in the software. The statistics can be reset through the keypad of the device, allowing customers to keep track of statistics over certain time periods. This feature does not erase the data recorded, but only resets the statistics count.

The RFVolt2000A-160mV model is a wireless, differential voltage data logger. The device is equipped with a three position terminal block to allow for a positive, negative and ground connection. This allows the measurement of the voltage difference between two signals tied to the same ground.

Selection Buttons

The logger is designed with 3 direct selection buttons: Scroll, Units and Wireless.

- **Scroll:** Allows user to scroll through current readings, average stats and device status information displayed on the LCD Screen.
- **Units:** Allows user to change displayed units of measurement, V/mV/uV/ Engineering Units
- **Wireless:** Push and hold this button for 5 seconds to activate or deactivate wireless communication.
- **Manual Reset Option:** Allows user to manually reset the statistics within the device to 0 without needing to use the MadgeTech software. Any data recorded up to that point is recorded and saved.

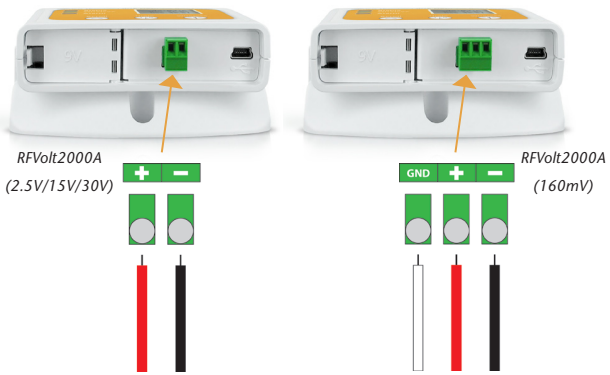
LED Indicators

- **Status:** Green LED blinks every 5 seconds to indicate unit is logging.
- **Wireless:** Blue LED blinks every 15 seconds to indicate unit is operating in wireless mode.
- **Alarm:** Red LED blinks every 1 second to indicate an alarm condition.

Connecting Information

Port Information

The RFVolt2000A data logger terminal ports are located on the bottom of the device, one positive and one negative. On the 160mV model, there is also a ground terminal port.



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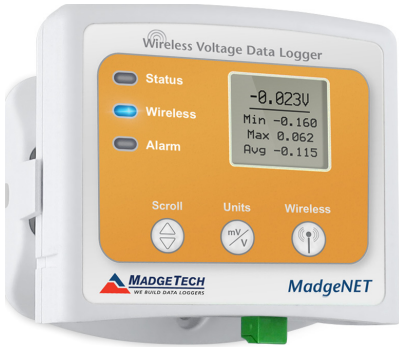
Additional Features and Operation

Alarm Settings/Rules

In MadgeTech 4, alarms can be created on two levels; in the software itself, and programmed specifically to the data logger. Creating alarm rules in the software allows the user to utilize alarms while real time recording, and have the added benefit of features such as e-mail and SMS notification. An alarm that is programmed on the data logger will only alert the user from the device itself, whether that is by a flashing LED, audible alarm, or local LCD notification.



Creating a Real time Alarm Rule

1. Within the Device tab in MadgeTech 4, in the Alarms group, click **Manage Rules**, then select **New**.
2. Enter a name in the Rule name box, and select whether notifications will occur when **All** conditions are met or **Any** condition is met.
3. Select the desired conditions to have met before notifications occur, and select which notifications will occur from the drop down menus.
4. If selecting to receive notifications by email or text message, click **Email settings** and make sure the correct info has been entered. Email and text message notifications will not be received if settings are incorrect.
5. Click **OK**. The **OK** button will be disabled if the Rule name box is empty.

Changing the Alarm Settings of a Device

1. In the Connected devices panel, select the RFVolt2000A device.
2. Click the **Properties** button under the device tab at the top of the software, and select the **Alarm** tab in the **Properties** window.
3. The High and Low settings indicate reading thresholds at which the alarm becomes active.
4. The Delay setting indicates how long to wait before the alarm becomes active after passing an alarm threshold.
5. The Use cumulative alarm delay checkbox indicates whether the alarm delay should reset when reading values fall back within the alarm threshold.
6. Once the alarm is configured appropriately, click **Apply** to save the settings.

Please refer to the Help file in the MadgeTech software for more information regarding alarm settings

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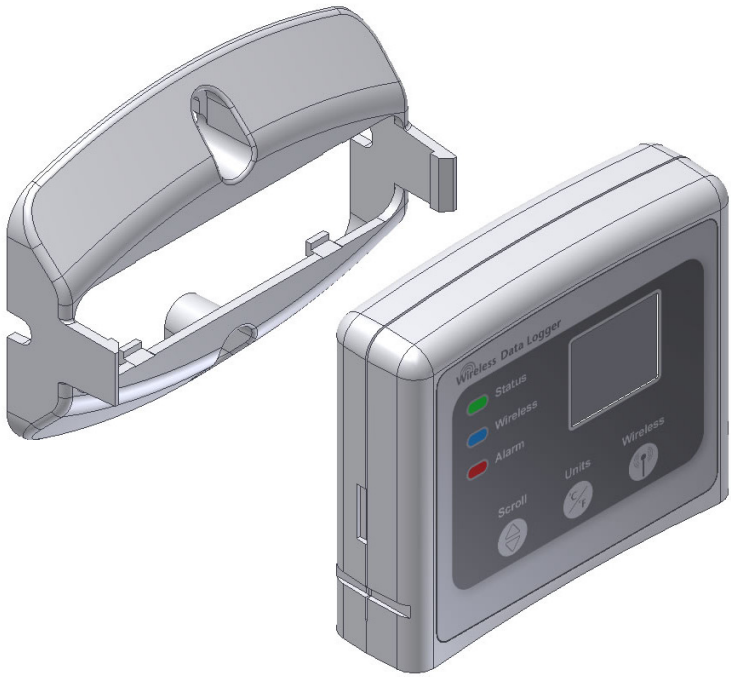
Mounting Instructions

The base provided with the RFVolt2000A can be used in two ways.

- The bottom of the logger snaps in place to use and mount the unit on a table top or horizontal surface.
- The base can also securely snap to the backside of the logger for wall mounting if desired (as shown below).
- There are two holes in the base to allow for screws for mounting.



Still need help? For more troubleshooting tips and information, refer to the built in help section of the MadgeTech 4 software, visit our Knowledge Base online at www.madgetech.com/kbase or contact us for customer support at 603-456-2011.

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Product Maintenance

Battery Replacement

Materials: U9VL-J Battery

1. On the bottom of the enclosure, open the battery compartment by pulling in on the cover tab.
2. Remove the battery by pulling it from the compartment.
3. Install the new battery, taking note of the polarity.
4. Push the cover closed until it clicks.

Recalibration

Standard recalibration for the RFVolt2000A-2.5V are two points, 0V and 2.5V. For the RFVolt2000A-15V, the standard calibration points are 0V and 15V. For the RFVolt2000A-30V the standard calibration points are 0V and 25V. For the RFVolt2000A-160mV the standard calibration points are 0V and 100mV+/-1mV.

Recalibration is recommended annually for any MadgeTech data logger; a reminder is automatically displayed in the software when the device is due.

RMA Instructions

To send a device back in to MadgeTech, follow the instructions below to create an RMA (Return Merchandise Authorization) on the MadgeTech website:

1. Visit **www.madgetech.com**, under the **Services** tab select **RMA Process**.
2. When the web page opens, please sign in. If this is the first time, select **Click here to register an account** and create one. Once signed in, click on the **Make New RMA** button and fill in all the blank fields.
3. Complete the applicable fields on the form including customer Billing and Shipping information, even if they are the same. Please see the field explanation below for a more detailed description about questions asked in the Device Information section.
4. When all of the fields are complete, click **Generate RMA**.
5. Print out the confirmation page that follows containing the RMA number and MadgeTech's address for shipping. **A Return Merchandise Authorization must be accompanied by a copy of the RMA paperwork and shipping is prepaid by the customer**. The RMA number should be clearly marked on the outside of the package.
6. Please ship the package via UPS, FedEx, TNT, or DHL to the address listed on the confirmation page. USPS will not ship MadgeTech data loggers.
7. A notification email will be automatically sent when MadgeTech has received the RMA.

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RFVolt2000A General Specifications

Reading Rate	1 reading every second up to 1 reading every 24 hours
Memory	32,256 readings
LED Functionality	• Green LED blinks every 5 seconds to indicate unit is logging • Blue LED blinks every 15 seconds to indicate unit is in wireless mode • Red LED blinks every 1 second to indicate alarm condition
Memory Wrap Around	Yes
Start Modes	Immediate Start & Delay Start
Battery Type	Ultralife 9V lithium battery included; user replaceable
Battery Life	5 years typical at 15 minute reading rate
Time Accuracy	±1 minute/month
Computer Interface	USB to mini USB, 250,000 baud for standalone operation or RFC1000 required for wireless operation
Software	XP SP3/Vista/Windows 7/Windows 8 (MadgeTech 4 only)
Operating Environment	-20°C to +60°C (-4°F to +140°F); 0 to 95% RH non-condensing
Dimensions	3.5" x 3.0" x 0.95" (88.9mm x 76.2mm x 24.1mm) - Data logger only
Weight	4.1 oz (0.2563 lbs)
Enclosure Material	ABS Plastic
Alarm	User configurable audible, on-screen, email and text (SMS) alarms. Alarm Delay: A cumulative alarm delay may be set in which the device will activate the alarm (via LED) only when the device has recorded a user specified time duration of data.
Audible Alarm Functionality	1 Beep per second for reading alarm above/below threshold
Overload Protection	±50 Volts (V) for 2 seconds
Approvals	US (FCC), CA (IC), CE, South Korea (KCC)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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Measurement

Sensor Type	Voltage Sensing Circuitry
Response Time	150mS at Sensor
Measurement Range	-3VDC to +3VDC for 2.5V -8VDC to +24VDC for 15V -8VDC to +32VDC for 30V -160mVDC to +160mVDC for 160mV
Measurement Resolution	2.5VDC (0.1mVDC) 15VDC (0.5mVDC) 30VDC (1.0mVDC) 160mVDC (5uV)

Wireless

RF Frequency	2.45GHz IEEE 802.15.4 ultra-low power MadgeNET wireless transceiver with fully bi-directional communication
Band	ISM band 2.405-2.475 GHz Operation (channels 11 through 25) @ 250 kbps
Maximum Output Power	+0dBm typical
Receiver Sensitivity (RFC1000)	-95dBm typical
Transmission Distance (to other RFC1000's)	• RFC1000 4,000' max. outdoors - line of sight unobstructed 1,000' max. indoors - typical urban environment • RFC1000-CE 2,500' max. outdoors - line of sight unobstructed 700' max. indoors - typical urban environment • RFC1000-IP69K 4,000' max. outdoors - line of sight unobstructed 1,000' max. indoors - typical urban environment
Transmission Distance (to data loggers)	• RFC1000, RFC1000-CE & RFC1000-IP69K 2,000' max. outdoors - line of sight unobstructed 500' max. indoors - typical urban environment

Battery Warning

WARNING: MAY LEAK, FLAME OR EXPLODE IF DISASSEMBLED, SHORTED, CHARGED, CONNECTED TOGETHER, MIXED WITH USED OR OTHER BATTERIES, AND/OR EXPOSED TO FIRE/HIGH TEMPERATURE. DISCARD USED BATTERY PROMPTLY, KEEP OUT OF REACH OF CHILDREN.

Specifications subject to change.
See MadgeTech's terms and conditions at www.madgetech.com

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RFC1000

Wireless Transceiver

Other models available:

RFC1000-CE - Approved for European markets

RFC1000-IP69K - Splash Proof for harsh environments

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Product Overview

MadgeTech has designed the RFC1000, a high powered transceiver that has a substantially long transmission range, providing enhanced performance in occluded environments (ovens, refrigerators, etc.). The RFC1000 also features an external antenna, allowing more flexibility with mounting positions in both orientation and proximity to metal walls. The device may be used as a repeater, or directly plugged into the Windows PC.

Transmission Distance

The RFC1000 transmits to other RFC1000s up to 4000 feet maximum typical outdoors/line of sight, 1000 feet maximum typical indoors/urban. The RFC1000 transmits to data loggers up to 2000 feet maximum typical outdoors/line of sight, 500 feet maximum typical indoors/urban. The RFC1000 can connect to a maximum of 64 data loggers. The RFC1000 transmits on a frequency of 2.405GHz - 2.475 GHz.

Operating Environment

The RFC1000 is rated for use in an environment with temperatures from -20°C to 85°C and a humidity range of 0% to 95% RH non-condensing. The RFC1000 is rated IP40 and is protected against solids that are greater than 1mm in size. This device is not water resistant.

LEDs

The red LED indicates that the device has power. The green LED will blink when communicating with other MadgeTech devices.

Installation Guide

Installing the MadgeTech 4 Software

Insert the MadgeTech 4 Software Flash Drive into an open USB port on a Windows PC. If the autorun does not appear, locate the drive on the computer and double click on **Autorun.exe**. Follow the instructions provided in the Installation Wizard. Software can also be downloaded from the MadgeTech website at the following link: **www.madgetech.com/software-download.**

1. Locate the **Autorun.exe** file on the MadgeTech 4 Software Flash Drive.

2. Select "**MadgeTech Software**" in the MadgeTech Installer Options window panel.

3. If the Windows PC doesn't already have .NET 4.0 Framework, installation may be required. *Note: To see if the .NET 4.0 Framework is installed, go to the Windows **Control Panel** and select **Programs**. "**Microsoft .NET Framework 4.0**" would be listed as a Windows program.*

   Select "**Install MadgeTech Software**" if .NET framework is installed on the Windows PC, or if installing on a Windows 8 machine.

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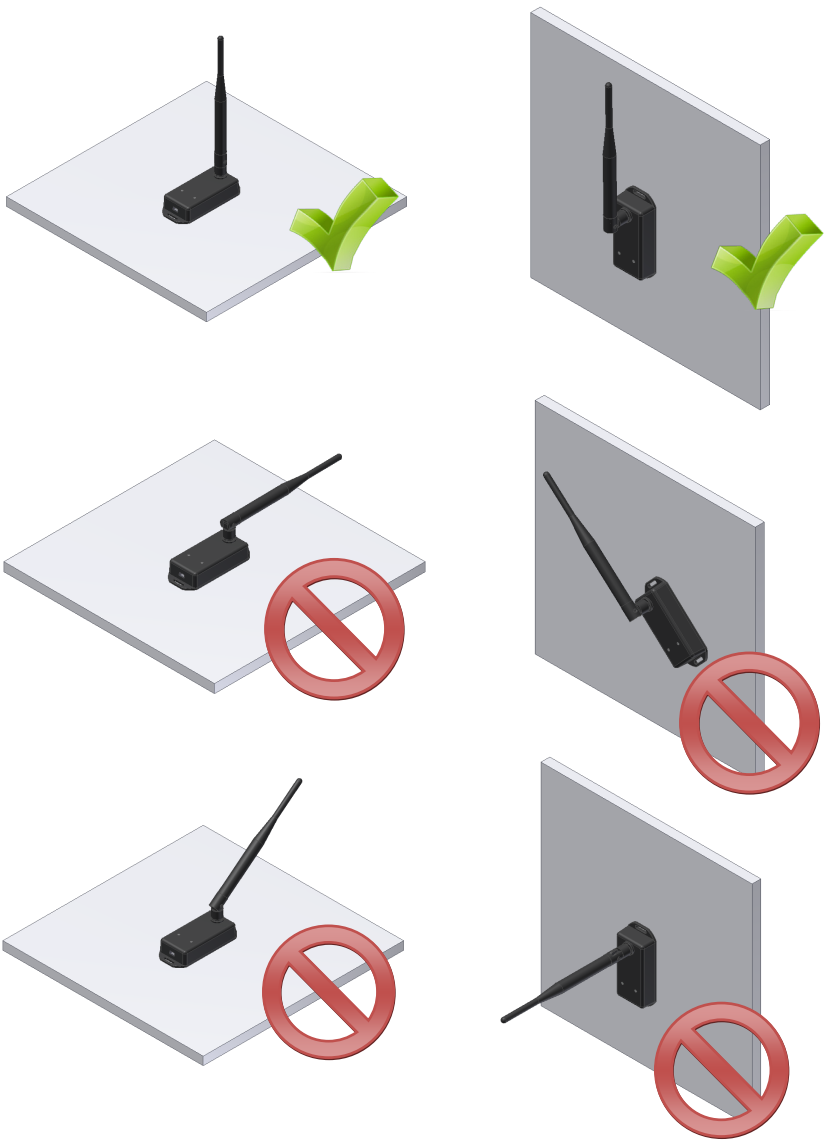
Mounting Instructions

For best wireless performance, both the RFC1000 and the MadgeTech data loggers should be mounted in the same orientation. This usually means that the external antenna should be pointing straight up. The antenna can pivot to accommodate either a wall mount or a desk mount.



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Channel Programming

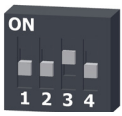
The RFC1000 transmits data on the 2.4GHz band and is programmed by default on channel 11. Each MadgeTech Wireless Data Logger and RFC1000 has a set of dip switches with which the channel may be programmed.

Different wireless channels may be used to create multiple networks in one area, or to avoid wireless interference from other devices. Any MadgeTech data logger or RFC1000 that is on the same network is required to use the same channel. If all of the devices are not on the same channel, the devices will not communicate with one another.

The images below show the orientations available of the switches for each channel. Channel 26 (all switches in the up position) is not supported.

Channel 11

Channel 12

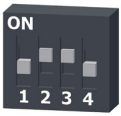


Channel 13

Channel 14

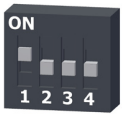
Channel 15

Channel 16



Channel 17

Channel 18



Channel 19

Channel 20

Channel 21

Channel 22

Channel 23

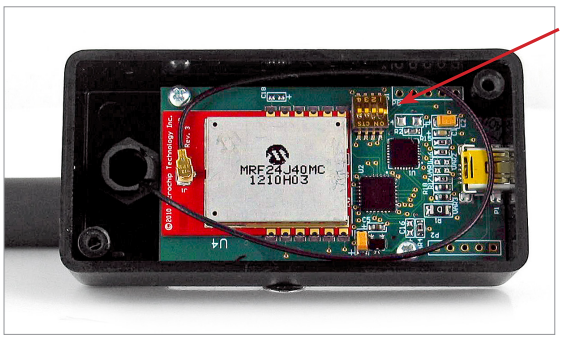
Channel 24

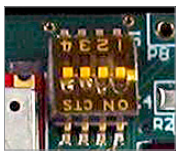
Channel 25

Channel 26
(not supported)

Follow the instructions below to configure the channel settings of the RFC1000

1. To program the channel on an RFC1000, first unplug the RFC1000.
2. Use a Phillips head screwdriver to unscrew the enclosure.
3. Find the dip switches located on the front of the PCB circuit board.
4. Change the dip switches to match the the desired channel using the diagram above.
5. Screw the enclosure back together and reconnect the RFC1000.




Close-up

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RFVolt2000A: To program the channel on the RFVolt2000A data logger, start by switching the wireless mode to **OFF** by holding down the **Wireless** button on the data logger for 5 seconds.

Step 1: Use the USB Cable, plug the USB end of the cable into an available USB port on the PC.

Step 2: Plug the opposite end of the cable into the communication port on the RFVolt2000A.

Step 3: Open the MadgeTech Software. Locate and select the RFVolt2000A in the **Connected Devices** panel.

Step 4: In the **Device** tab, click the **Properties** icon. The **Properties** screen will display information about the device including **Wireless** setting.

Step 5: Under the **Wireless** tab, select a desired channel (11-25) that will match with the RFC1000. **Save** all changes, disconnect the data logger, and return the device to wireless mode by holding down the **Wireless** button for 5 seconds.

Deploying and Activating Devices

Step 1: Plug the RFC1000 into the USB port on the base station computer. *(Additional RFC1000s can be used as repeaters to transmit over greater distances)*

Step 2: If using multiple RFC1000s plug each one into a wall outlet in the desired locations. *(If transmitting over a distance greater than 1000 feet indoors or 4000 feet outdoors or there are walls/obstacles/corners that need to be maneuvered around, set up additional RFC1000s as needed.)*

Step 3: Verify that the data loggers are in wireless transmission mode. *(See Channel Programming steps above)*

Step 4: On a Windows PC, launch the Madgetech 4 software program. All active data loggers will be listed in the software showing that the device(s) are recognized.

Step 5: To activate the data loggers, click on one to highlight, then click the **Claim** icon, and then click the **Start** button. Do this for each logger in the list that needs to be activated.

RFC1000 General Specifications

Interface Type	USB (to PC) / Wireless (to Data Logger)
Operating Environment	-20°C to +85°C, 0 to 95%RH non-condensing
LED Indicators	Red & Green
Enclosure Materials	ABS Plastic (body), PVC Plastic (antenna)
Dimensions	Enclosure: 3.8" x 1.6" x 0.8" / Antenna: 7.2"
Approvals	FCC ID:OA3MRF24J40MC, IC#: 7693A-24J40MC
Transmission Distance (To other RFC1000s)	4000' max. outdoor - line of sight unobstructed 1000' max. indoors - typical urban environment
Transmission Distance (To data loggers)	2000' max. outdoor - line of sight unobstructed 500' max. indoors - typical urban
Maximum number of connected data loggers	64
Frequency	2.405GHz - 2.475GHz
Ingress Protection	IP40

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Compliance Information

• "This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation."

• "To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter."

• "This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

• "Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante."

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Troubleshooting Tips

Why is the wireless data logger not appearing in the software?

If the RFVolt2000A doesn't appear in the Connected Devices panel, or an error message is received while using the RFVolt2000A, try the following:

- Check that the RFC1000 is properly connected. For more information, see Troubleshooting Interface Cable problems (below).
- Ensure that the battery is not discharged. For best voltage accuracy, use a voltage meter connected to the battery of the device. If possible, try switching the battery with a new 9V lithium.
- Ensure that no other MadgeTech software (such as **MadgeTech 2**, or **MadgeNET**) is running in the background.
- Ensure that **MadgeTech 4** is being used. **MadgeTech 2** and **MadgeNET** are not the correct software for connecting with the RFVolt2000A.
- Ensure that the **Connected Devices** panel is large enough to display devices. This can be verified by positioning the cursor on the edge of the Connected Devices panel until the resize cursor appears, then dragging the edge of the panel to resize it. The screen layout may also be reset in the options menu by selecting **File**, **Options**, and scrolling to the bottom.

Troubleshooting Interface Cable problems

Check that the software properly recognizes the connected RFC1000 wireless transceiver.

If the wireless data logger is not appearing in the **Connected Devices** list, it may be that the RFC1000 is not properly connected.

1. In the software, click the **File** button, then click **Options**.
2. In the **Options** window, click **Communications**.
3. The **Detected Interfaces** box will list all of the available communication interfaces. If the RFC1000 is listed here, then the software has correctly recognized and is ready to use it.

Check that Windows recognizes the connected RFC1000 wireless transceiver.

If the software does not recognize the RFC1000, there may be a problem with Windows or the USB drivers.

1. In Windows, click **Start**, right-click **Computer** and choose **Properties** or press **Windows+Break** as a keyboard shortcut.
2. Click **Device Manager** in the left hand column.
3. Double click **Universal Serial Bus Controllers**.
4. Look for an entry for **Data logger Interface**.
5. If the entry is present, and there are no warning messages or icons, then windows has correctly recognized the connected RFC1000.
6. If the entry is not present, or has an exclamation point icon next to it, the USB drivers may need to be installed. These are available on the software flash drive included with the RFC1000, and on the MadgeTech website.

Ensure that the USB end of the RFC1000 is securely connected to the computer.

1. Locate the USB-A plug of the RFC1000.
2. If the interface cable is connected to the PC, unplug it. Wait ten seconds.
3. Reconnect the cable to the PC.
4. Check to make sure that the red LED is lit, indicating a successful connection.